

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 7651 (1997): Wire Reinforced Rubber Covered Hydraulic Hose [PCD 13: Rubber and Rubber Products]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



भारतीय मानक
तार पुनर्प्रबलित रबड़ चढ़े द्रवचालित हौज — विशिष्टि
(दूसरा पुनरीक्षण)

Indian Standard
WIRE REINFORCED RUBBER COVERED HYDRAULIC
HOSE — SPECIFICATION
(*Second Revision*)

ICS 23.040.80 : 83.140.40

©BIS 1997

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Rubber Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was first published in 1975 and revised in 1979 to incorporate strength properties of lining and cover both before and after ageing, burst test and ozone resistance test. Some modifications had also been done in material requirements and swelling in oil test. In the light of experience gained in the last few years, the committee decided to revise it again in order to align with latest International Standards. In this revision a new variety of hose of type 3 has been incorporated. Additional nominal bore of 28.5 mm, 35.0 mm and 46 mm only for type 3 hose has been included and strength properties of lining and cover have been deleted. Swelling in oils and ozone resistance test have been made as optional. In addition to the above, modifications have also been made in scope, impulse test and construction. This standard is essentially based on ISO 1436: 1991 'Rubber hoses and hose assemblies — wire reinforced hydraulic type — Specifications', issued by ISO and also assistance was taken from the standard published by Society of Automotive Engineers, USA, SEA J517 'Hydraulic Hose' during preparation of this standard. Impulse test is essential for checking the performance of such hoses. However, since the testing facilities for this test are not yet available in the country, therefore this test has been made optional. It will be made obligatory after the facilities for testing are available.

Dimensional details of normally used hose have been given in Annex A for information only.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified in this standard.

Indian Standard

WIRE REINFORCED RUBBER COVERED HYDRAULIC HOSE — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard covers general, dimensional and performance specifications of three types of embedded wire hose of internal diameter from 5 mm to 51 mm, suitable for use with common hydraulic fluid such as mineral oils, soluble oils, oil and water emulsions, aqueous glycol solutions, and water at temperature ranging from -40°C to $+100^{\circ}\text{C}$.

1.2 This hose is not suitable for use with castor oil based and ester based fluids.

1.3 This standard does not include requirements of end fittings. It is limited to the performance of the hose and hose assemblies.

2 NORMATIVE REFERENCES

The following Indian Standards contain provision which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on the standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	Title
443 : 1975	Methods of sampling and test for rubber hoses (<i>second revision</i>)
3400	Methods of test for vulcanized rubbers
(Part 6) : 1983	Resistance to liquids (<i>first revision</i>)
(Part 20) : 1994	Ozone cracking — Static strain test (<i>first revision</i>)
7503	Glossary of terms used in rubber industry
(Part 1) : 1988	Definition of basic terms (<i>first revision</i>)
(Part 2) : 1988	Definition of additives (<i>first revision</i>)

IS No.

Title

(Part 3) : 1988	Definition relating to properties and testing (<i>first revision</i>)
(Part 4) : 1988	Definition relating to processing (<i>first revision</i>)
(Part 5) : 1988	Definition relating to products — Hoses (<i>first revision</i>)
(Part 6) : 1986	Definition relating to cellular materials

3 TERMINOLOGY

For the purpose of this standard, the various definitions given in different parts of IS 7503 shall apply.

4 TYPES

This standard covers three types of hoses depending on the construction and designed working pressure as indicated in 6.2 and 6.5 respectively.

5 DIMENSIONS

Dimensional details and tolerances applicable to these types of hoses are given in Annex A.

6 REQUIREMENTS

6.1 Materials

6.1.1 Lining

The lining shall consist of synthetic rubber compound resistant to oil, grease, glycol, etc.

6.1.2 Reinforcement

The reinforcement shall be by one or more layers of high tensile steel wire. Cotton or synthetic fibre may also be used along with steel wire.

6.1.3 Cover

The cover shall consist of a suitable rubber compound resistant to oil and weather.

6.2 Construction

6.2.1 For Type 1

This hose shall consist of a seamless inner tube of oil resistant synthetic rubber, a single wire braid reinforcement and an oil and weather resistant synthetic rubber cover. A ply or braid of suitable material may be used over the inner tube and/or over the wire reinforcement to anchor the synthetic rubber to the wire.

6.2.2 For Type 2

The hose shall consist of a seamless inner tube of oil resistant synthetic rubber, two braids of wire reinforcement and an oil and weather resistant synthetic rubber cover.

6.2.3 For Type 3

The hose shall consist of a seamless inner tube of oil resistant synthetic rubber and two textile braids separated by a high tensile steel wire braid. All braids are to be impregnated with an oil and mildew resistant synthetic rubber compound. Alternately, in addition to inner tube the hose can have one textile braid, one reinforcing braid of high tensile steel wire and an outer of oil and weather resistant synthetic rubber.

6.2.4 Concentricity

The inside diameter of hose shall be concentric with outside diameter of the hose within following limits:

Nominal ID mm	Concentricity ID to OD in mm	
	Type 1 and 2	Type 3
Up to and including 6.3	0.8	—
Up to and including 10.3	—	0.6
Over 6.3 to 22.0	1.0	—
Over 10.3	—	0.8
Over 22.0	1.3	—

6.3 Bore

The bore shall meet the requirement of Table 1.

6.4 Tolerance on Length

6.4.1 The hose shall be supplied in lengths as specified by the purchaser, subject to a tolerance on specified lengths of ± 1 percent or ± 3 mm, whichever is the greater.

6.4.2 When no specific lengths have been ordered, the percentages of different lengths in any given delivery shall be as follows:

Over 13 m	Not less than 65 percent
7.5 m to 13 m	Not more than 35 percent
1 m to 7.5 m	Not more than 10 percent

No lengths shall be less than 1 m.

Table 1 Permitted Range of Bore Size
(Clause 6.3)

Nominal Bore mm	Permitted Range			
	Type 1 and 2		Type 3	
	Minimum	Maximum	Minimum	Maximum
5.0	4.6	5.4	4.8	5.5
6.3	6.2	7.0	6.4	7.2
8.0	7.7	8.5	7.9	8.7
10.0	9.3	11.1	10.0	11.1
12.5	12.3	13.5	12.7	13.7
16.0	15.5	16.7	15.9	17.0
19.0	18.6	19.8	—	—
22.0	21.8	23.0	22.2	23.3
25.0	25.0	26.4	—	—
28.5	—	—	28.6	29.8
31.5	31.3	33.0	—	—
35.0	—	—	34.9	36.1
38.0	37.7	39.3	—	—
46.0	—	—	46.0	47.2
51.0	50.4	52.0	—	—

6.5 Pressure Ratings

The design working pressure of the hose shall comply with requirements of Table 2.

6.6 The hose shall withstand without damage a proof test pressure of twice the design working pressure when tested according to the method prescribed in 8.3 of IS 443 : 1975.

6.7 Minimum Bend Radius and Change in Length at Design Working Pressure

6.7.1 The hose shall be capable of performing at design working pressure when curved to a radius not smaller than that given in Table 3. If the hose is curved to a radius smaller than the specified bend radius, performance capability of the hose will be reduced.

6.7.2 The change in length of hose at the design working pressure shall not be greater than + 2 percent to - 4 percent.

Table 2 Design Working Pressure
(Clause 6.5)

Nominal Bore mm	Design Working Pressure (Bar)		
	Type 1	Type 2	Type 3
5.0	210	350	210
6.3	200	350	210
8.0	175	300	160
10.0	160	280	—
10.3	160	—	140
12.5	140	250	120
16.0	105	200	105
19.0	90	160	—
22.0	80	140	55
25.0	70	140	—
28.5	—	—	45
31.5	45	110	—
35.0	—	—	35
38.0	35	90	—
46.0	—	—	25
51.0	26	80	—

Table 3 Band Radius and Change in Length
(Clause 6.7.1)

Nominal Bore mm	Bend Radius mm	
	Types 1 and 2	Type 3
5.0	90.0	75.0
6.3	100.0	85.0
8.0	115.0	100.0
10.0	130.0	—
10.3	140.0	115.0
12.5	180.0	140.0
16.0	200.0	165.0
19.0	240.0	—
22.0	280.0	185.0
25.0	305.0	—
28.5	—	230.0
31.5	420.0	—
35.0	—	270.0
38.0	510.0	—
46.0	—	340.0
51.0	635.0	—

6.8 Cold Flexibility

Hose or hose assembly or both shall be subjected to a temperature of -40°C for 24 h. After this time and while still at -40°C , the sample shall be flexed for 8 to 12 s over a mandrel having a diameter equal to twice the minimum bend radius specified in Table 3. Hose up to and including 22 mm in diameter shall be bent through 180° over the mandrel and hose larger than 22 mm diameter shall be bent through 90° over the mandrel. After flexing, the sample shall be allowed to warm to room temperature and shall be visually examined for cover cracks and subjected to a proof test as described in 6.6. There shall be no cover crack or leakage.

6.9 Burst Test

A 45 cm length of hose shall be subjected to burst test in accordance with 8.2 of IS 443 : 1975. The bursting pressure shall be not less than 4 times the working pressure.

6.10 Change in Length Test

The determination of elongation or contraction shall be conducted on a previously untested, unaged hose assembly having at least 300 mm length of free hose between hose couplings. The hose assembly shall be attached to the pressure source and pressurized to the operating pressure for a period of 30 s, after which time the pressure shall be released. After allowing the hose to stabilise for a period of 30 s, following pressure release, the reference marks 250 mm apart shall be accurately placed on the hose outer cover, midway between the hose couplings. The hose then shall be repressurised to the specified pressure for a period of 30 s, after which time, while the hose is repressurised, the distance between the reference marks shall be measured. The difference between this final length and original length will indicate the change in length.

For all the three type of hoses that is, Type 1, 2 and 3 the change in length shall not exceed +2 percent to - 4 percent.

7 OPTIONAL REQUIREMENTS

7.1 Impulse Test

7.1.1 Four unaged samples of hose with end fittings shall be tested. The free length of hose under test shall be computed using the following:

$$\begin{aligned} & \text{90 degree bend free length} \\ &= \frac{\pi (\text{Min bend radius})}{2} + 2 (\text{hose OD}) \end{aligned}$$

180 degree bend free length

$$= \pi (\text{Min. bend radius}) + 2 (\text{hose OD})$$

Straight free length

$$= 14 - 18 \text{ in } (356 - 457 \text{ mm})$$

7.1.2 The test machine for testing a hose assembly should have the requisite facilities for maintaining specified parameters. A typical schematic hydraulic circuit for the hose test rig is given for guidance in Fig. 1.

- a) Means should be available for applying a pulsating pressure internally to a hose assembly at a rate of between 30 to 75 cycles per minute.
- b) The internal pulsating pressure curve must fall entirely within the shaded area of Fig. 2 and should conform as closely as possible to the curve as shown. The rate of pressure rise during the first part of the pressure impulse cycle shall be between 3 500 and 7 500 bar/sec (350 and 750 Mpa/sec) determined as illustrated in Fig. 3.
- c) The test fluid to be used in the test shall be fully fortified mineral oil having the following chemical characteristics:

Maximum pour point	28°C
Minimum flash point	190°C
Airline point	$100 \pm 10^{\circ}\text{C}$
Viscosity	$46 \text{ mm}^2/\text{s}$ at 40°C

7.1.3 The test pieces shall be connected to the apparatus and in the case of hoses up to and including 22 mm nominal bore, they shall be bent through 180° so that the fittings are parallel and the distance between the two ends of the hose at the fittings is twice the minimum bend radius, + 5 percent - 0 as shown in Fig. 4. Hose over 22 mm nominal bore shall be left in a straight condition or alternatively bent through 90° .

7.1.4 Type 1

Hose when tested at 125 percent of the design working pressure for hoses of nominal bore 25 mm and smaller, and at 100 percent of the design working pressure for nominal bore 31.5 mm and above at a temperature of $93 \pm 5^{\circ}\text{C}$ shall withstand a minimum of 150 000 impulse cycles.

7.1.5 Type 2

Hose when tested at 133 percent of the design working pressure at a temperature of $93 \pm 5^{\circ}\text{C}$ shall withstand a minimum of 200 000 impulse cycles.

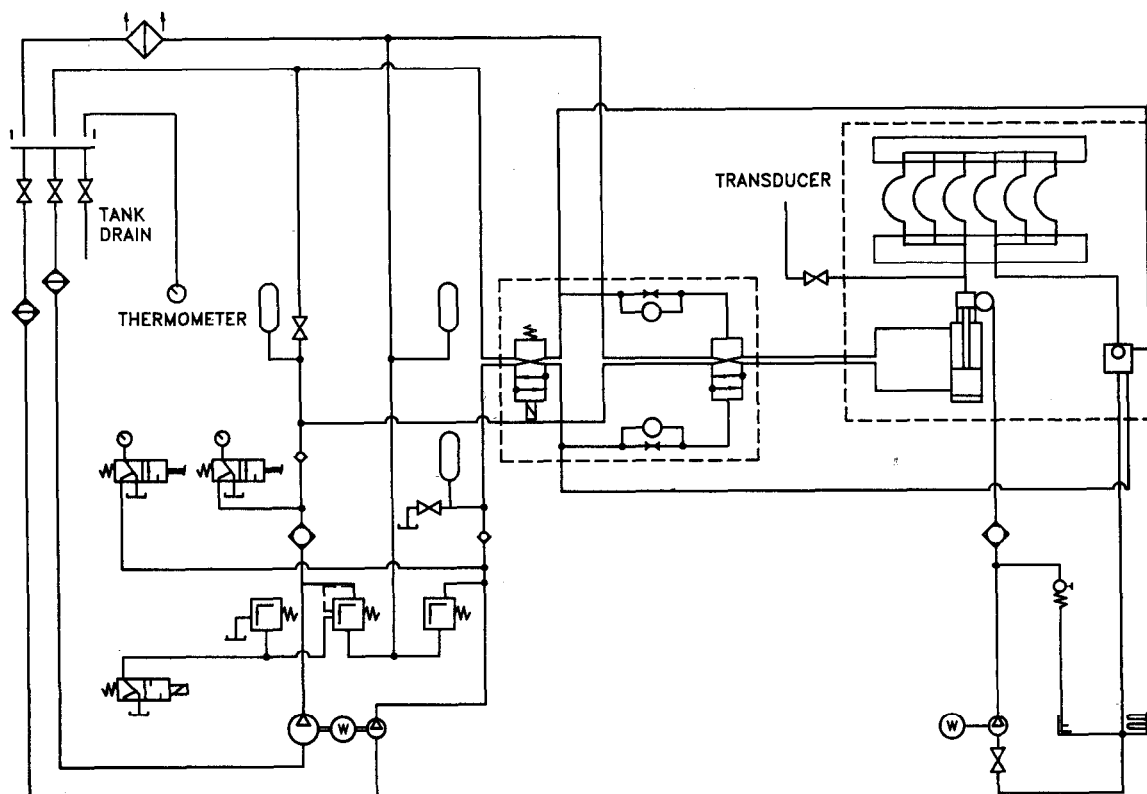


FIG. 1 TYPICAL SCHEMATIC HYDRAULIC CIRCUIT FOR THE HOST TEST RIG

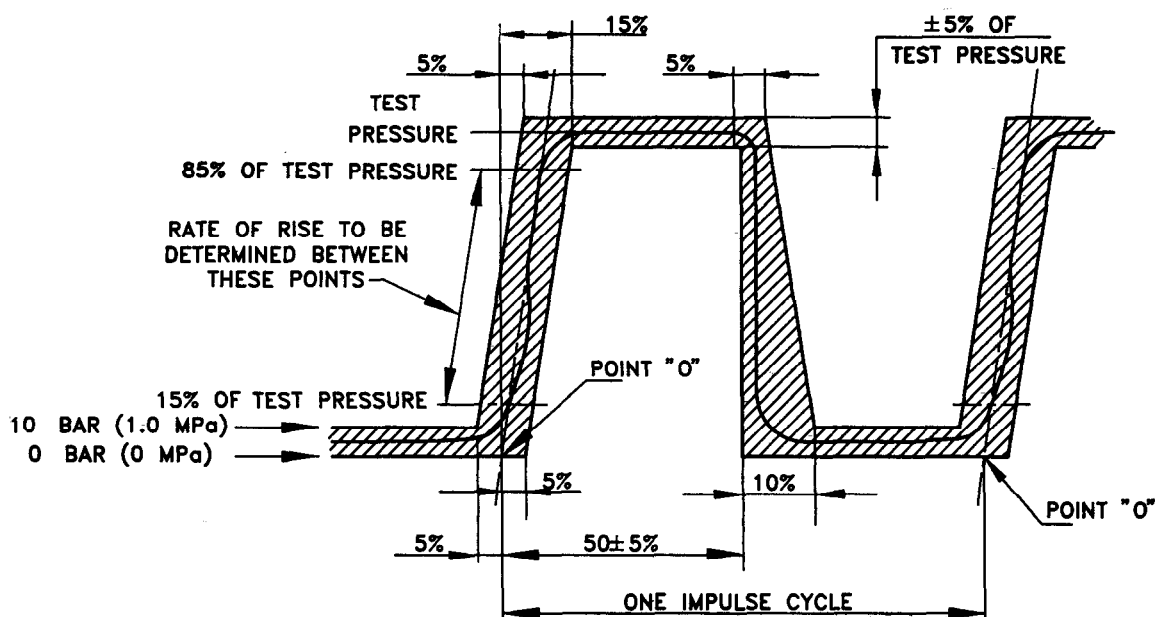


FIG. 2 PRESSURE IMPLUSE CYLCE

7.1.6 Type 3

Hose when tested at 125 percent of the design working pressure for hoses of nominal bore 22 mm and smaller and 100 percent of operating pressure for hose sizes

28.5 mm or larger shall withstand a minimum of 150 000 impulse cycles for hose size up to 22 mm and smaller and 100 000 cycles for sizes 28.6 mm and larger. There will be no leakages or other malfunction after the specified number of impulse cycles.

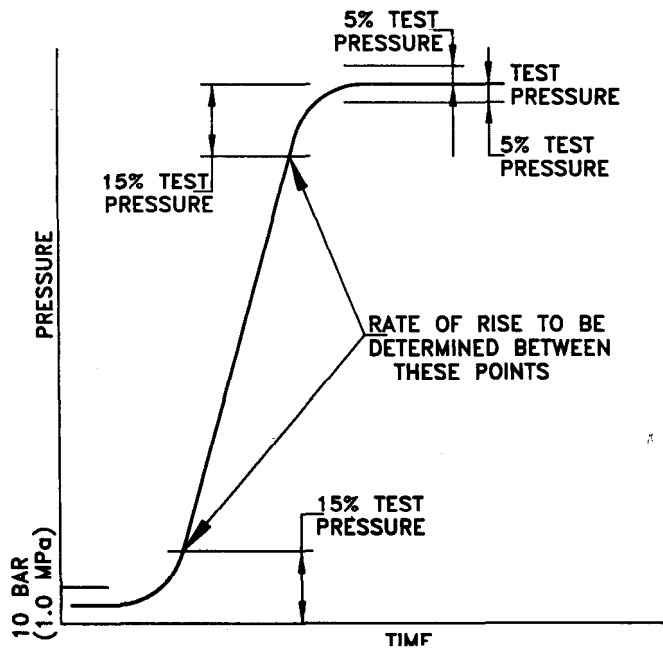


FIG. 3 METHOD OF DETERMINATION OF RATE OF PRESSURE RISE IN IMPLUSE TEST

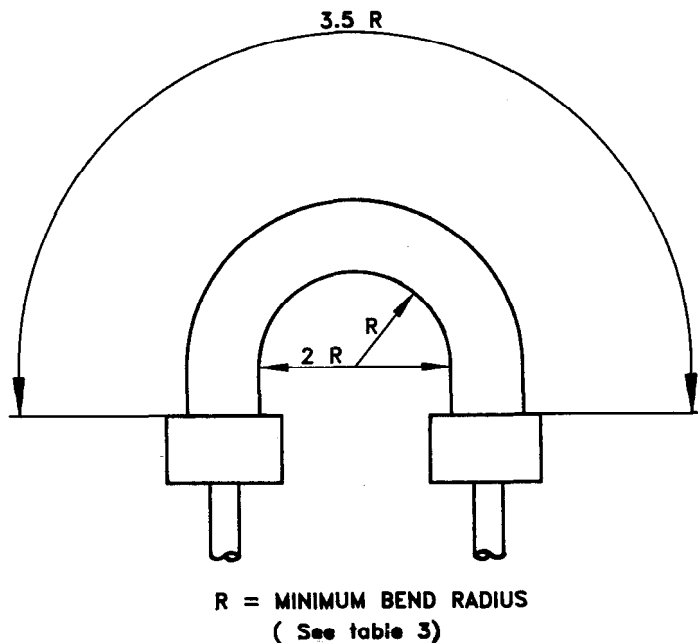


FIG. 4 ATTACHMENT OF HOSE FOR IMPLUSE TEST

NOTE — Any failure adjacent to the end fittings shall be disregarded and repeat tests are carried out. Failure due to coupling blow off or rupture adjacent to the fittings (within 25 mm) shall not be interpreted as a true hose burst but as failure due to the fittings attachment and recorded as such.

7.2 Swelling in Oils

When representative samples of rubber of lining and cover of the hose are subjected to swelling

at $100 \pm 1^\circ\text{C}$ for 72 h in oil No. 3 specified in IS 3400 (Part 6) : 1983, the volume shall not increase by more than 100 percent when tested according to the method prescribed in 11 of IS 443 : 1975.

7.3 Ozone Resistance Test

If agreed to between the purchaser and the supplier, the hose may be subjected to ozone resistance test in accordance with IS 3400 (Part 20) : 1994. For this,

the test piece shall be exposed for 70 h in an atmosphere composed of 50 parts of ozone per 100 million parts of air at an ambient temperature of 38°C. The specimen shall not show evidence of cracking or deterioration when viewed with $\times 7$ magnification while still in a stressed condition.

8 PACKING AND MARKING

8.1 Packing

The material shall be packed as agreed to between the purchaser and the supplier.

8.2 Marking

8.2.1 Each length of hose shall be indelibly marked adjacent to each end with the following:

- a) Name of the material,
- b) Indication of the source of manufacture,
- c) Batch or lot number,
- d) Nominal diameter and type of hose, and
- e) Month and Year of manufacture.

8.2.2 BIS Certification Marking

Each length of hose may also be marked with Standard Mark.

8.2.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 SAMPLING AND CRITERIA FOR CONFORMITY

For the purpose of ascertaining the conformity of the hose in a consignment to this specification, the scale of sampling and the criteria for conformity shall be as prescribed in 3 of IS 443 : 1975.

10 TEST METHODS

The test shall be carried out according to the methods prescribed in the specification.

ANNEX A
(Foreword and Clause 5)

DETAILS OF DIMENSIONS AND TOLERANCES OF WIDELY USED HOSE SIZES

Nominal Bore mm	Type 1						Type 2						Type 3			
	Hose I.D. mm		Reinforced Dia mm		Hose O.D. mm		Hose I.D. mm		Reinforced Dia mm		Hose O.D. mm		Hose I.D. mm		Hose O.D. mm	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1)																
5.0	4.6	5.4	8.9	10.1	11.9	13.5	4.6	5.4	10.6	11.7	15.1	16.7	4.8	5.5	12.7	13.7
6.3	6.2	7.0	10.6	11.7	15.1	16.7	6.2	7.0	12.1	13.3	16.7	18.3	6.4	7.2	14.3	15.3
8.0	7.7	8.5	12.1	13.3	16.7	18.3	7.7	8.5	13.7	14.9	18.3	19.8	7.9	8.7	16.7	17.6
10.0	9.3	11.1	15.1	16.4	19.8	21.4	9.3	10.1	16.1	17.3	20.6	22.2	10.3	11.1	18.9	20.0
12.5	12.3	13.5	17.5	19.0	22.2	23.8	12.3	13.5	19.0	20.6	23.8	25.4	12.7	13.7	22.8	24.0
16.0	15.5	16.7	20.6	22.2	25.4	27.0	15.5	16.7	22.2	23.8	27.0	28.6	15.9	17.0	26.8	28.0
19.0	18.6	19.8	24.6	26.2	29.4	31.0	18.6	19.8	26.2	27.8	31.0	32.5	—	—	—	—
22.0	21.8	23.0	27.8	29.4	32.5	34.1	21.8	23.0	29.4	31.0	34.1	35.7	22.2	23.3	30.6	32.2
25.0	25.0	26.4	32.5	34.1	36.9	39.3	25.0	26.4	34.1	35.7	38.5	40.9	—	—	—	—
28.5	—	—	—	—	—	—	—	—	—	—	—	—	28.6	29.8	37.3	38.9
31.5	31.4	33.0	39.3	41.7	44.4	47.6	31.4	33.0	43.2	45.6	49.1	52.4	—	—	—	—
35.0	—	—	—	—	—	—	—	—	—	—	—	—	34.9	36.1	43.7	45.2
38.0	37.7	39.3	45.6	48.0	50.8	54.0	37.7	39.3	49.6	52.0	55.6	58.5	—	—	—	—
46.0	—	—	—	—	—	—	—	—	—	—	—	—	46.0	47.2	55.2	57.6
51.0	50.4	53.0	58.7	61.9	65.1	68.3	50.4	53.0	62.3	64.7	68.3	71.4	—	—	—	—

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. PCD 13 (853).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 323 01 31, 323 94 02, 323 33 75

Telegrams: Manaksanstha
(Common to
all offices)

Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002

Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola
CALCUTTA 700054

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022

Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600113

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
MUMBAI 400093

Telephone

{ 323 76 17
323 38 41

{ 337 84 99, 337 85 61
337 86 26, 337 86 62

{ 60 38 43
60 20 25

{ 235 02 16, 235 04 42
235 15 19, 235 23 15

{ 832 92 95, 832 78 58
832 78 91, 832 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR.
COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR.
KANPUR. LUCKNOW. NAGPUR. PATNA. PUNE. THIRUVANANTHAPURAM.